Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Entanglement, Fluctuations, and Quantum Critical Points STEPHAN RACHEL, Department of Physics, Yale University, New Haven, CT 06520, USA , NICOLAS LAFLORENCIE, Laboratoire de Physique Theorique, Universite de Toulouse, UPS, (IRSAMC), F-31062 Toulouse, France , H. FRANCIS SONG, Department of Physics, Yale University, New Haven, CT 06520, USA, KARYN LE HUR, Center for Theoretical Physics, Ecole Polytechnique, 91128 Palaiseau Cedex, France and Department of Physics, Yale University, New Haven, CT 06520 — We show that bipartite fluctuations F can be considered an entanglement measure. We further demonstrate that the concept of bipartite fluctuations F provides a very efficient tool to detect quantum phase transitions in strongly correlated systems. We investigate paradigmatic examples for both quantum spins and bosons in one and two dimensions. As compared to the von Neumann entanglement entropy, we observe that F allows to find quantum critical points with a much better accuracy in one dimension. We further demonstrate that F can be successfully applied to the detection of quantum criticality in higher dimensions with no prior knowledge of the universality class of the transition. Promising approaches to experimentally access fluctuations are discussed for quantum antiferromagnets and cold gases.

Stephan Rachel
Department of Physics, Yale University, New Haven, CT 06520, USA

Date submitted: 10 Nov 2011 Electronic form version 1.4